FNA Atomic Flask Wagon

550009-550014 built by BREL Ashford in 1976.
550015-550016 built by BREL Ashford in 1978.
550017-550018 built by BREL Shildon in 1982.
550020-550026 built by BREL Swindon in 1986.
550027-550060 built by Procor in 1988.

Nuclear Flask Wagons

Operation – Direct Rail Services operate all nuclear flask movements in Britain. This was originally a wholly owned subsidiary of BNFL, the public sector company that manages the Sellafield nuclear plant in Cumbria. BNFL has now been renamed the Nuclear Decommissioning Authority. The NDA owns all the nuclear flasks. Nuclear flask wagons travel exclusively in a train of one, two or maybe three vehicles hauled [but sometimes topped and tailed] by two locomotives. This is to prevent stranding in no–mans–land in the event of a locomotive failure.

Nuclear Power Stations and Spent Fuel – Nuclear reactors depend upon the availability of one particular isotope of uranium known as U235. This is a rare isotope, since in nature it is outnumbered approximately 140 to 1 by another isotope U238. The special property of U235 is that it easily undergoes nuclear fission – when a slow moving neutron collides with an atom of U238, it suddenly becomes so unstable that it splits into two major fragments accompanied by two or three extra neutrons. Associated with this is a large release of energy, contained mainly in the kinetic energy of the fragments, which is quickly dissipated as heat. The energy release is so large by ordinary standards that the heat from the fissioning of all the atoms in one pound of U235 is as much as from burning 1500 tons of coal.

The major fragments of each fission [which include strontium–89 and caesium–137, both of which are highly radioactive] absorb neutrons but they are not fissionable themselves. In other words, the fission products are themselves moderators. Typical uranium fuel elements will last about four years before the build up of fission [waste] products makes it less efficient. The fuel elements are then taken from the reactor, allowed to cool under water in a concrete pond and then processed separately, not only to remove the fission products but also to separate the unused uranium–235 and to make it available for the manufacture of new fuel elements.

About 27tonnes of used fuel is taken each year from the core of a 1000MW nuclear reactor. In the reprocessing, the spent fuel elements are dissolved in nitric acid and separated chemically into uranium, plutonium and high–level waste solutions. About

97% of the used fuel can be recycled, leaving only 3% as high–level waste. The recyclable portion is about 99% uranium–235, with about 1% plutonium–239 [about 230kilograms per year] which can be mixed with fresh Mixed Oxide Fuel for use in MOX reactors.

The British Nuclear Fuels Limited [BNFL] plant at Sellafield in Cumbria processes the spent fuel elements from British nuclear power stations, from Royal Navy nuclear powered warships and submarines and from some overseas power stations. The spent fuel elements are highly radioactive and have to be contained in a steel flask for safe transportation.

Nuclear Flask Wagons used exclusively on BR

[i] – The first type of nuclear flask wagon was the 50 ton FLATROL MJ Twenty–four wagons being built in the early 1960s –

Diagram 2/532 FLATROL MJ. 24 were built at Swindon Jan 1961 – Dec 1963 [Lot 3300] Nos. B900509–B900532. Six–wheel bogies – they were later modified with FBT6 four–wheel bogies. The livery was probably BR Freight Brown [bauxite], as the wagons were vacuum braked.

[ii] – The next type of nuclear flask wagon was the 50 ton FLATROL MJJ, which in a later classification became XXB Flask. Six of these were built in 1970.

Diagram 2/534 XXB FLASK [FLATROL MJJ]. Six were built at Shildon Jan 1970–Apr 1970 [Lot 3697] Nos. 550000–550005 FBT6 with four–wheel bogies.

The livery is confirmed as BR Freight Brown [bauxite], although the wagons were air–braked as were all BR freight wagons built after the mid–1960s. Also a custom–fitted, white–painted, protective heat shield was provided.

[iii] – The final type of nuclear flask wagon were 52 vehicles built in six Lots 1976 and 1989, which were designed to carry a differently shaped and smaller 50–ton nuclear flask. Since 1991 these have become the only type of flask and wagon used to convey spent fuel from British nuclear power stations to Sellafield.

XXB FLASK [XK 002A]. Six were built at Ashford Nov. 1976 – Jan 1977 [Lot 3886] Nos. 550000–550014 FBT6 four–wheel bogies.

XXB FLASK [XK 003A] two were built at Ashford Nov 1978 – Dec 1978 [Lot 3928] Nos. 550015–550016 FBT6 four–wheel bogies. To these were added Nos. B900509–B900532 which were given FBT6 four–wheel bogies and vacuum through pipes becoming MJJ. All those and the Lot 3697 wagons above [Nos. 550000–550005] were withdrawn by 1991. *[**Editor and Proof Reader note.** The numbers don't add up as it would appear that there were 15 XK002a wagons and the rest looks a bit jumbled!]*

XB FLASK [XK 003A] two were built at Shildon Apr 1982 [Lot 4004] Nos. 550017–550018 FBT6 four–wheel bogies.

FNA FLASK [FN002A] two were built at Swindon 1984 [Lot 4040] Nos. 550019–550020 FBT6 four–wheel bogies.

FNA FLASK [FN003A] six were built at Swindon 1986 [Lot 4057] Nos. 550021–550026 FBT6 four–wheel bogies.

FNA FLASK [FN 003A] 24 were built by Procor [UK] Ltd. 1988 [Lot 4049] Nos. 550027–550050 FBT6 four–wheel bogies.

FNA FLASK [FNOO3A] ten were built by Procor [UK] Ltd. 1989 [Lot 4063] Nos. 550051–550060 FBT6 four–wheel bogies.

No. 550019 was destroyed in an accident deliberately staged on 17 July 1984
The remaining 51 wagons were transferred to TRANSRAIL Ltd in January 1994 and to DIRECT RAIL SERVICES in February 1995. They are still in active service.

[iv] – In addition to handling the spent fuel from British nuclear power stations, the BNFL works at Sellafield processed spent nuclear fuel from overseas reactors. Spent nuclear fuel from Japan arrived at the Barrow–in–Furness docks from where the flasks were carried up the Cumbrian coast to Sellafield and between 1977 and 1987, BREL at Ashford built nine large well wagons for this BNFL traffic.

Nuclear Flask Wagons used for Continental Traffic– Until 1995 Nuclear Transport Ltd operated a number of eight–axle nuclear flask wagons to convey spent nuclear fuel from nuclear power stations in Italy, Switzerland and the Netherlands, via the [then] Harwich and Dover train ferries, to Sellafield. Most numerous were the eight French–registered 105 tonne capacity vehicles built by Fauvet Girel between 1977 and 1991 to Diagram E475. Fitted with two–piece sliding flask covers, they measured 19.46 metres [76ft.8in.] over headstocks.
Nuclear Transport Ltd operated two 90 tonne capacity nuclear flask wagons built to Diagram E697 by Waggon Union that were used to carry irradiated fuel from the German light–water reactors at Gundremmingen abd Unterweser. These had two eight–wheel bogies and carried [yet again] differently shaped and heavier flasks than those used to convey spent nuclear fuel from UK nuclear power stations.


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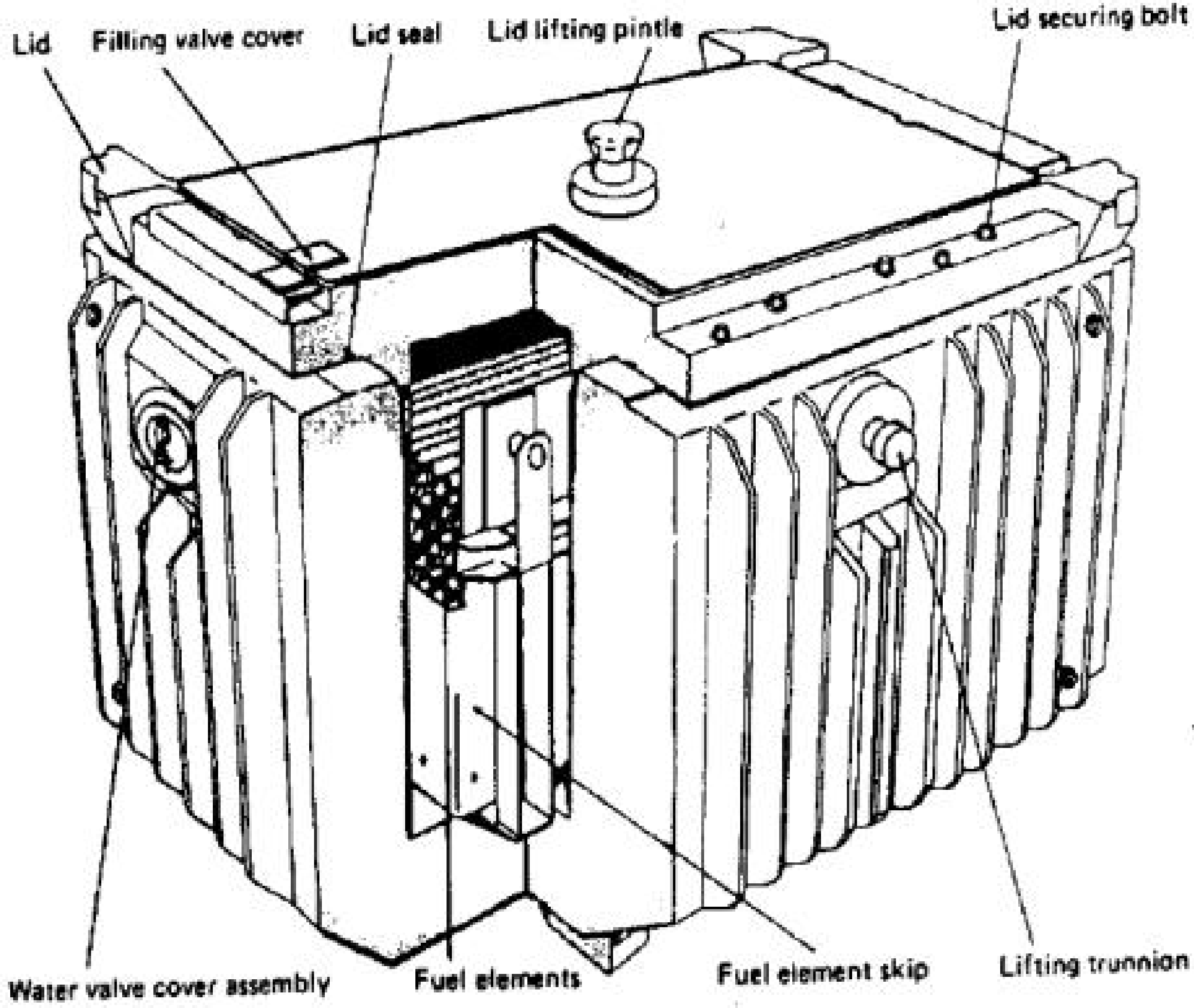

Flasks for transporting Magnox and AGR fuel are almost identical.

Specifications	Magnox Flask:	AGR Flask:
Gross Weight:	47 tons	53 tons
Outer dimensions:	Approx 2.5m cube	Approx 2.5m cube
Internal dimensions:	2.6m x 2.2m x 1.9m	2.7m x 2.3m x 2.0m
Wall thickness:	370mm	90mm
Fuel Rod Capacity:	200	20

DECOMMISSIONING AND DISPOSAL OF 22 FUEL FLASK TRANSPORT WAGONS

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ABSTRACT

AEA Technology is currently decommissioning a fleet of redundant fuel flask transport wagons on behalf of Nuclear Electric. The project is in two stages: the systematic dismantling of 3 wagons to provide information to determine a disposal strategy; decommissioning and disposing of the fleet. The first stage is complete, and a case for free release of the bulk of each wagon was based upon the results. The case was approved by the regulatory authority and decommissioning of the remaining 19 wagons began in October 1989. The work is on schedule, and will be completed to time and cost in April 1991. On completion, 540 te steel will have been disposed of by free release, and sold to the scrap metal market.

BACKGROUND

In the UK, irradiated fuel is commonly moved between power plants and the Sellafield reprocessing plant by rail. The fuel is contained in transport flasks which are loaded onto specially designed wagons known as Flatrols.

The original fleet of 22 wagons is now redundant and has been replaced with new rolling stock. It was known that some of the redundant wagons had become very slightly contaminated during their 20 years operational life which complicated their disposal. The contamination is due to sweat-out of activity from the painted surfaces of the mild steel flasks which had previously absorbed activity during immersion in contaminated fuel pond water. The levels of contamination on the Flatrols are very low and have complied with IAEA transport requirements during their long and reliable operational life.

The wagons consist of a central flask-carrying well 3.2 m long, which is suspended at each end from a platform 5.5 m long. These three sections constitute the flatbed, which has an overall length of 15.8 m and weighs 27.5 te. The flatbed is mounted on two pairs of bogies to form the Flatrol wagon which has an all-up weight of 37.5 te.(Fig. 1)

However, before a disposal route could be identified and agreed with the appropriate UK regulatory authorities a detailed knowledge of contamination levels was required.

The project was carried out by AEA Technology on behalf of Nuclear Electric and was completed in two stages:

- Stage 1 -To systematically dismantle three Flatrols to determine the nature and extent of the contamination and to use this information to develop a disposal strategy and agree a safety case with the UK regulatory authorities.
- Stage 2 -To decommission and dispose of the remaining nineteen Flatrol Wagons.

The project was started in 1988 and the first stage completed in 1989; the second stage was started in late 1989 and is on schedule to be completed to time and cost in April 1991.

DECOMMISSIONING AND EXAMINATION OF THE FIRST FLATROL WAGON

Based on the information available from records the wagon likely to have the highest contamination levels was selected for detailed dismantling and examination.

The following strategy was adopted:

- Deliver the wagon to the Winfrith Technology Center; separate the flatbed from the bogies; transfer the flatbed to the decommissioning facility; return the valuable bogies, after monitoring, to the owner for reuse.
- Dismantle the flatbed, with direct probe monitoring at every stage.
- From the direct probe surveys, select a representative number of pieces for gamma spectroscopy in order to identify the radionuclides present.
- Chemically decontaminate all contaminated pieces and determine the total activity on the wagon.

Before dismantling, the entire flatbed was washed with high pressure water to remove loose material and the washings collected for radiochemical analysis. The results showed no contamination above background, implying that all contamination was fixed to the wagon.

The flatbed was systematically dismantled using, as far as possible, cold cutting methods (pneumatic chisels, grinders and electric nibblers); flame cutting was used where cold cutting was not possible.

Each piece was monitored, numbered, and recorded on a manifest sheet.

CONTAMINATION ON THE FIRST FLATROL

Direct probe monitoring showed the contamination on the first wagon was limited to the central well area. Fig. 2 shows schematically the location of contamination on the stainless steel cladding of the well, and Fig. 3 shows the girderwork revealed after removal of the cladding. Contamination on the girderwork is located mainly at the joints

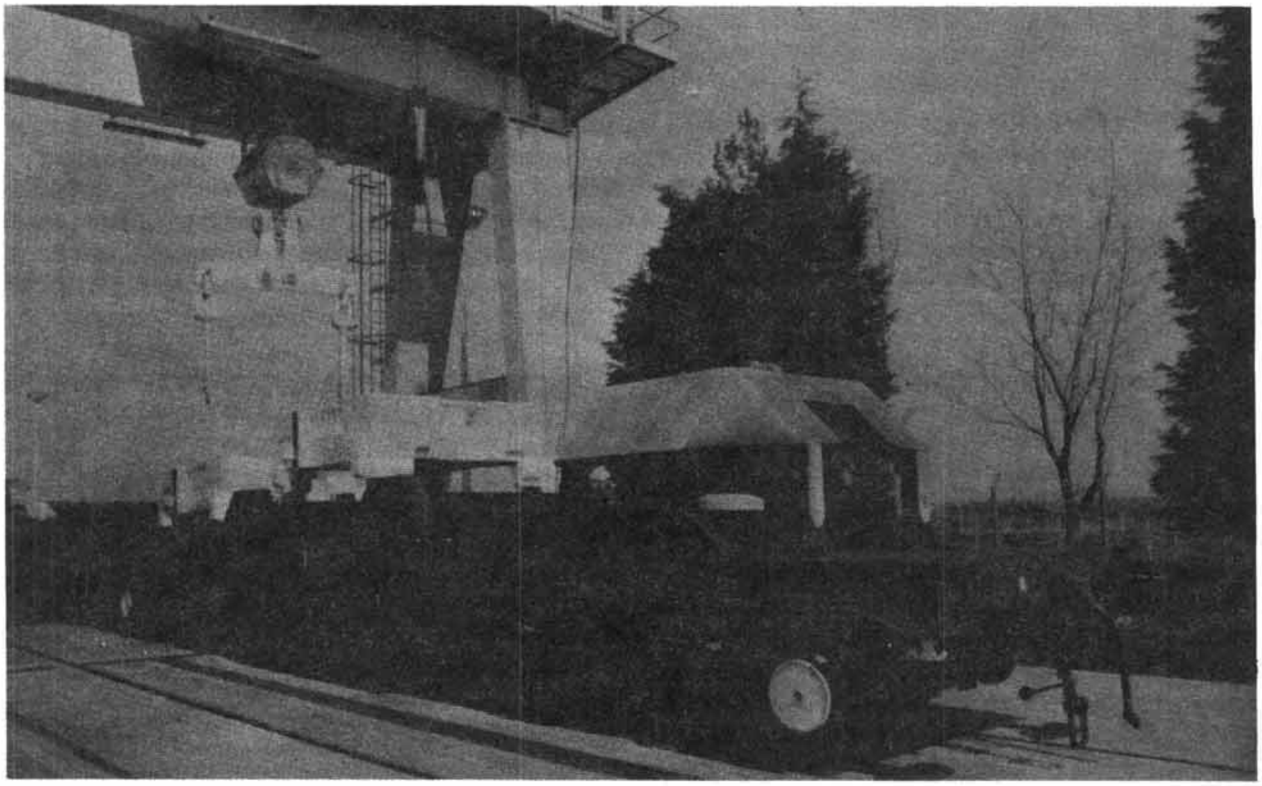

Fig. 1. A flatrol wagon.

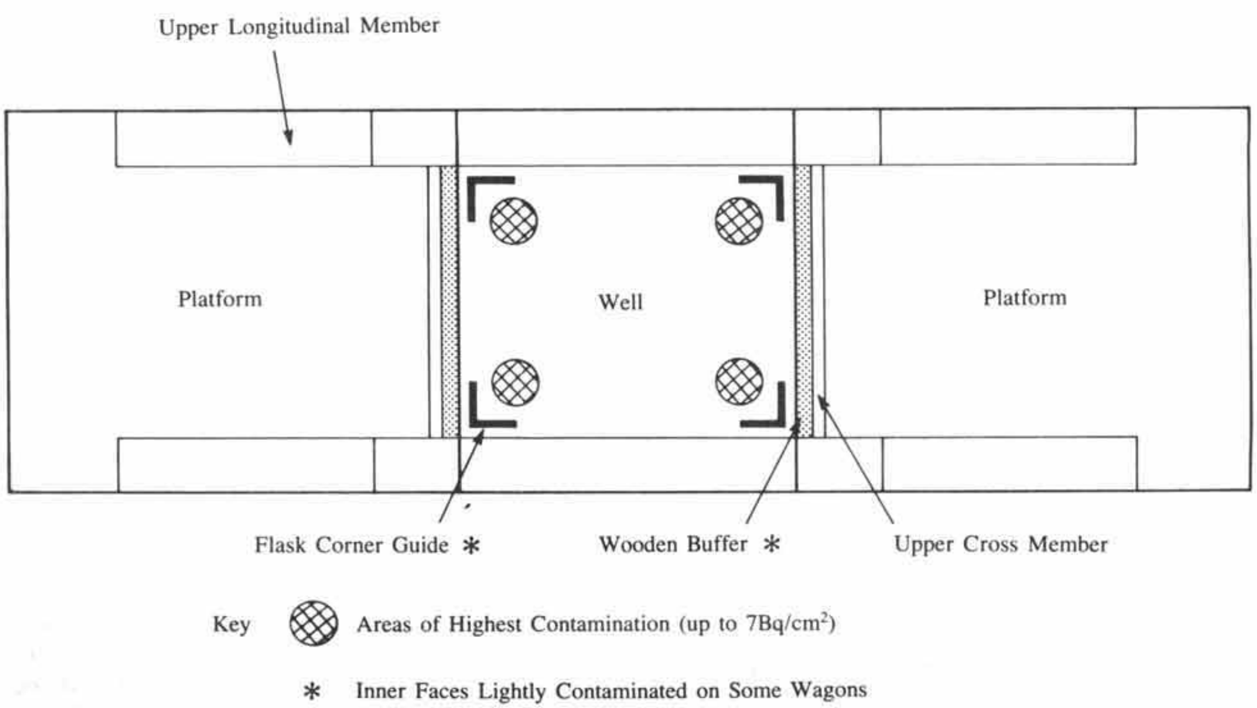

Fig. 2. Plan view of flatrol showing main components and contaminated areas in well section.

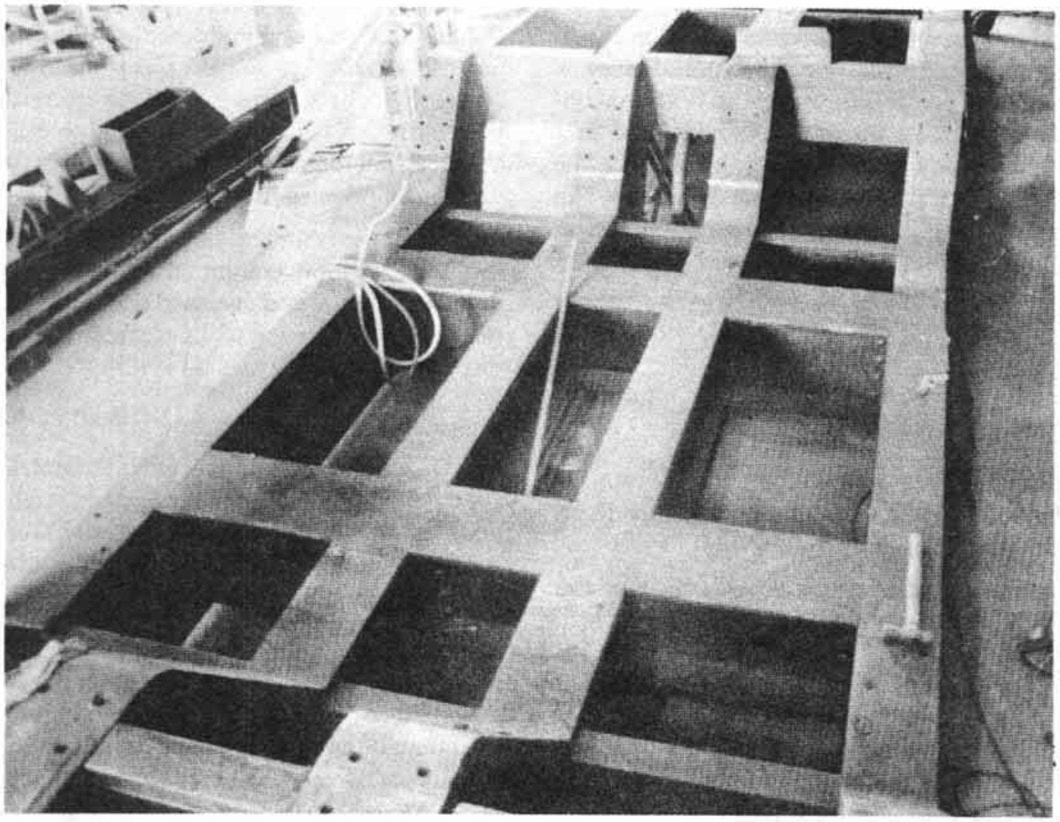

Fig. 3. Girder work beneath cladding. Contamination is confined to the well section, and located mainly at the joints.

between the four longitudinal members, and the six central cross-members.

Care was taken to expose all surfaces not normally available for routine monitoring, including the opening of box sections as it was envisaged that the traces of contamination could have been widely transported by weather effects.

Contamination levels were relatively low - the highest spot on the cladding was 50 cps (= $7Bq/cm^2$) and on the girderwork, 600 cps (= $80Bq/cm^2$).

Gamma spectrometric analysis of selected contaminated pieces revealed that caesium was the principal contaminant, with much smaller quantities of cobalt also present.

Chemical decontamination of all contaminated pieces, followed by radiochemical analysis of the spent liquor was used to determine the total quantity of activity on the flatbed. The results showed that total beta activity was 37 MBq and total gamma was 1.1 MBq. This activity was confined to 8% by weight of the flatbed. (ie 2.2 te)

THE FIRST FLATROL - CONCLUSIONS

The work demonstrated that 92% by weight of the flatbed was uncontaminated and suitable for disposal as clean scrap steel. The remaining 8% by weight, all originating from the central well area could be classified as low level waste and could be sent for disposal at the UK's shallow land disposal site at Drigg in Cumbria. The relatively low value of scrap steel would not justify the cost of decontamination to unrestricted release levels.

DECOMMISSIONING OF THE 2ND AND 3RD FLATROLS

Two further Flatrols were decommissioned in the same painstaking manner as the first, with the objective of confirming the results and to gain further experience, so that a carefully costed decommissioning plan could be prepared for the rest of the Flatrol fleet. The strategy adopted for the first wagon was applied to the second and third with the emphasis on examining and demonstrating the uncontaminated nature of the 'clean' pieces.

EXAMINATION OF THE CLEAN PIECES

In the UK, 0.4 Bq/g is the limit below which material is regarded as non-active and suitable for free release. Therefore, all metal pieces from a wagon complying with this requirement could be sold on the conventional scrap metal market. However, it is necessary to gain approval from the relevant regulatory authorities first. (in the UK, Her Majesty's Inspectorate of Pollution) Such approval is

granted on a case-by-case basis. To achieve this it is necessary to demonstrate conclusively that the material is below this limit. A number of pieces, representative of the uncontaminated areas of the two wagons were examined in a shadow shield whole body monitor, normally used for the routine monitoring of radiation workers at Winfrith. The monitor is capable of quantitatively measuring activity levels as low as 0.001Bq/g. Measurements showed that activity levels on the material were well below the 0.4 Bq/g limit.

THE 2ND AND 3RD FLATROLS - CONCLUSIONS

Work on the second two Flatrols confirmed the conclusions drawn from the examination of the first, ie:-

- ~90% of the flatbed is uncontaminated
- the ~10% that is contaminated is located exclusively in the central well region and is fixed
- all contaminated material can be classified as low level waste
- the uncontaminated parts have activity levels that have been shown to be less than 0.4 Bq/g and are suitable for unrestricted release

This stage of the project was completed in 1989.

DECOMMISSIONING OF THE REMAINING 19 FLATROLS

The information obtained during the decommissioning and examination of the first three wagons was used to draw up a decommissioning plan for the remaining 19. A vital part of the plan was to submit a robust case to the regulators for the unrestricted release of the uncontaminated parts of the flatbeds.

The case was based on evidence such as the Whole Body Monitor measurements and the application of a strictly controlled segregation procedure to ensure that contaminated and uncomtaminated material do not become mixed. The latter ensures that contaminated and uncontaminated pieces are assigned to low level waste disposal and free release, respectively.

The regulators approved the case in September 1989 and the task of decommissioning the fleet was commenced in October 1989; work is currently in progress, with each flatbed being carefully dismantled, the pieces segregated and disposed of as 'clean' scrap or low level waste, as appropriate. As a cross checking exercise, a number of pieces of each flatbed are subjected to examination in the Whole Body Monitor before the clean scrap from that wagon can be released.

When the contract is completed in April 1991, 22 wagons with a total weight of ~ 600 te will have been decommissioned and disposed of. Approximately 540 te of this will have been sold as clean scrap metal and 60 te disposed of as low level waste.

OVERALL CONCLUSIONS

On completion of the current contract for Nuclear Electric, approximately 540 te of clean steel, which has been associated with contaminated material, will have been sold as 'clean' scrap.

This has been achieved by applying quality assured procedures agreed with the regulatory authorities.

The work has been a valuable exercise in demonstrating the ability to free release significant quantities of uncontaminated material from the nuclear industry and at the same time conserving valuable space in the national low level waste repository.

BIBLIOGRAPHY

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ACKNOWLEDGEMENTS

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The authors also gratefully acknowledge the consistently splendid efforts of the Winfrith Technology Center Decommissioning Team which has enabled the project to run to time and cost.

GREATER**LONDON**AUTHORITY

London Assembly

Nuclear Waste Trains Investigative Committee

Scrutiny of the transportation of nuclear waste by train through London

October 2001

Foreword by the Chair of the Nuclear Waste Trains Investigative Committee

Most people will be aware that spent nuclear fuel has to be taken through London by train, on its way from the nuclear power stations in Essex, Kent and Suffolk up to the reprocessing facilities at Sellafield in Cumbria. The special trains must necessarily pass through built up areas, close to homes and schools. We carried out this scrutiny to examine what is being done to address safety issues.

We found that the transport of spent nuclear fuel in this country has an excellent safety record. Many millions of miles have been travelled by trains carrying flasks of nuclear material and no accident or incident has taken place involving the release of radioactivity.

But the Assembly, and the authorities concerned, are well aware that just because something hasn't gone wrong yet doesn't mean there can't be a problem tomorrow or the next day, and that constant vigilance is essential. Our investigations revealed some areas where we think sensible improvements could be made.

For example, there is a programme of rehearsals, known as "RADSAFE", to help make sure the emergency services are fully trained and ready to cope with any incident involving nuclear material. Unlike the Fire Service, the police and ambulance service have not yet attended RADSAFE training. They need to go. What is more, such an exercise has never taken place in London. We think it should.

Our recommendations are set out and explained in this report. We trust the authorities concerned will take note of it and implement it, and that members of the public will find it both interesting and helpful in explaining how this very important matter is being handled with their safety in mind.

My thanks to my colleagues on the committee, to our technical consultants Enviros Quantisci, and most of all to the many people who wrote or came in to give us the benefit of their views.

The Nuclear Waste Trains Investigative Committee

The Nuclear Waste Trains Investigative Committee was established by the Assembly on 5 July 2000 with the following membership:

Darren Johnson (Chair) - Green
Louise Bloom - Liberal Democrat
Angie Bray - Conservative
Roger Evans - Conservative
Toby Harris - Labour
Samantha Heath - Labour

The terms of reference of the Committee were as follows:

- To examine existing emergency planning in the event of a radiological release in an area of dense population and to explore the current situation of readiness of the emergency services and technical support offered by the nuclear industry; and,

- To examine the situation regarding trackside contamination in connection with the phenomena known as sweating or non-fixed contamination and other forms of trackside contamination, and the subsequent effect on surrounding communities.

Table of Contents

Executive Summary

This Assembly scrutiny Report brings together for the information of Londoners the facts on the transport of radioactive materials, especially spent nuclear fuels. It reviews the adequacy of current safety arrangements. In this Report we make no assumptions either for or against nuclear energy.

The transport of nuclear waste is a matter of legitimate concern for London. It is under continual review by the relevant authorities to ensure that all aspects of the transport are conducted safely. Spent nuclear fuel[1] has been transported by rail in the United Kingdom since 1962 and during that time some 6 million miles have been travelled. No incident involving the release of radioactivity has occurred during that period. This is a record to be welcomed. Any discussion of the risks and safety issues connected with the transport of nuclear waste must be seen in this context. But it is not an excuse for complacency. Were there to be a serious accident and major release of radioactivity the consequences for Londoners could be severe. It is essential that everything possible is being done to avoid such accidents and that the emergency services and authorities are fully prepared in the event of such an emergency taking place.

There will always be debate as to the safety of transporting spent nuclear fuel and there will always be the possibility of further improvements. Our investigation has revealed that there are some areas where action is needed – such as in the routing of trains, in risk assessment, emergency preparedness, monitoring and statutory inspection.

The GLA has a responsibility in all its activities to consider the health of Londoners. We commend this Report to both Mayor and Assembly, recommending that they adopt its proposals (listed in full at Annex A) and pursue their implementation with the Government and the relevant transport and nuclear energy authorities.

Our most important findings are:

- *Emergency planning*

  More can be done to secure emergency preparedness in London in the event of a serious incident. A London-based emergency exercise, known as a RADSAFE[2] exercise, must be conducted, with representatives of all the emergency services in London, not just the Fire Brigade, in attendance.

  There must be a review of public information arrangements in the case of an accident involving the transport of spent nuclear fuel.

- *Monitoring*

  The regulatory authorities, independently of DRS, must bring forward a more proactive programme to monitor radiation and contamination levels of trains and trackside.

[1] Annex C provides a glossary of technical terms such as spent nuclear fuel
[2] Annex D provides a list of all acronyms used

- *Trackside security*

  Railtrack[3], DRS and other operators must improve trackside security as a matter of urgency. This safety issue relates primarily to the obvious danger from moving trains. In addition there is the need to keep young people and others away from trains carrying nuclear waste or other hazardous substances and the need to provide a first line of defence against terrorists seeking access to the flasks when a train is stopped in a marshalling yard.

- *Risk assessment*

  There is a need for a London-based accident risk assessment of spent nuclear fuel transport. There should be consideration of whether a Joint Fact-Finding Study, enjoying the confidence of all interested parties, can be used for such an assessment.

- *Energy Review*

  The current government Energy Review must take into account questions of the transport of spent nuclear fuel in its deliberations.

- *Alternative routes*

  More must be done to examine the possibility of using alternative rail freight routes to transport spent nuclear fuel, bypassing both London and other major population centres.

- *Evidence from Government departments*

  We regret that DTLR, the HSE and National Radiological Protection Board (NRPB) all declined to give oral evidence to the Committee – especially as criticism was made by witnesses of the rigour of their inspection procedures. We recommend that the Assembly continue to press for civil servants to provide oral evidence to Assembly committees when this is necessary for the proper conduct of investigations.

- *The DTLR review*

  The GLA should be actively involved in the forthcoming review by DTLR of the road and rail transport of radioactive material. This is an important opportunity to communicate the concerns of many Londoners and follow through the conclusions of this Report.

This Report was prepared by the Nuclear Waste Trains Investigative Committee of the London Assembly. The Committee was grateful for technical advice from Phil Richardson, Graham Smith and Fred Barker of Enviros Quantisci.

[3] This Report was finalised before Railtrack was put into Railway Administration. The relevant recommendations of this Report apply to whatever successor body emerges.

1. Nuclear Waste Trains – The need for scrutiny

1.1 The subject of nuclear waste transport remains one guaranteed to excite controversy and strong feelings. Given the possibly serious effects of contamination this is not surprising. But it is vital for any consideration of the issue to separate fact from fiction, lay rumour to rest, and provide accurate information not just for the experts and those in authority, but also for the general public. Many are concerned by the transport by train of nuclear waste through London. In some instances this is because the facts have not been available or readily accessible. We believe this Report performs an essential public service in providing a comprehensive examination of the issue for Londoners.

1.2 The Committee notes that stringent procedures are already in place but is aware that bodies such as London Boroughs, the Fire Brigades Union, the European Parliament, and local London residents have voiced concerns over the transport of spent nuclear fuel.

1.3 Spent nuclear fuel[4] is just one of many types of radioactive material transported through London, including radioactive waste. Spent nuclear fuel has attracted the most attention, probably because it involves by far the largest amounts of radioactivity and the greatest potential, in the absence of appropriate mitigation measures, for contamination in the event of an accident.

1.4 We must take such concerns seriously if transport of spent nuclear fuel is to be safe and become safer. The Committee also notes that there is still a need to monitor compliance and consider further improvement. The establishment of the Greater London Authority, and a London Assembly with the specific brief of considering issues of significance to Londoners, is an opportunity to assess whether current arrangements are acceptable.

1.5 Some of the individuals and organisations who gave evidence to the Committee clearly believed that nuclear energy was wrong *per se*. We must, however, make clear at the outset that this scrutiny did not make any assumptions either for or against the use of nuclear energy. This matter was outside our terms of reference.

1.6 In the following paragraphs we consider:

- The current routing of spent nuclear fuel through London and the possibility of alternative routes
- The likelihood of an accident or terrorist attack occurring during transportation
- The adequacy of tests on the purpose built containers used to carry spent nuclear fuel ("package tests")
- The level of emergency preparedness
- The risks of contamination and levels of monitoring

[4] There are many types of radioactive waste other than spent nuclear fuel, generally very much less hazardous. Other radioactive materials, not radioactive waste, are transported through and within London, again generally very much less hazardous than spent nuclear fuel. Some people do not categorise spent nuclear fuel as a waste, but this does not affect the risks involved in the transport. The scrutiny exercise therefore focuses on spent nuclear fuel transport as presenting the greatest hazard and concern to Londoners. The term "nuclear waste trains" is used in this Report to refer to trains transporting spent nuclear fuel.

2. Why transport nuclear fuel through London?

2.1 There are three nuclear power reactor sites in the south-east of England generating electricity. They are at Dungeness in Kent (two Magnox reactors and two Advanced Gas Cooled Reactors (AGRs)), Bradwell in Essex (two Magnox reactors) and Sizewell in Suffolk (two Magnox reactors and one Pressurised Water Reactor (PWR)). Spent nuclear fuel from all three sites is transported to Sellafield in Cumbria by rail, and the routes used all pass through London.

2.2 It is the current practice for the spent nuclear fuel from these reactor sites to be reprocessed by British Nuclear Fuels plc (BNFL) in its facility at Sellafield. Fuel removed from the reactor cores is stored for a minimum period of 90 days in pools at the reactor sites to allow for initial cooling. It is then transferred to special shipping flasks and placed on rail wagons for shipment to Sellafield. We visited Sizewell 'A' nuclear power station (operated by BNFL Magnox) in Suffolk on 21st June 2001, to examine the process of spent fuel transfer from pool to flask.

2.3 Direct Rail Services (DRS) was established as a wholly-owned subsidiary of BNFL in 1995, based in Carlisle, to provide BNFL with a strategic rail transport service following the privatisation of the UK rail network. The company has 27 locomotives and more than 30 drivers and is certified to ISO9002 quality management standard. Drivers are mostly former British Rail and nuclear industry employees, with additional specialist training.

2.4 Sellafield has two reprocessing plants, the Thermal Oxide Reprocessing Plant (THORP) which treats uranium oxide spent fuels and the B205 Plant which treats Magnox spent fuel (uranium metal). THORP can also reprocess PWR fuel, but at the moment it is planned to store spent PWR fuel at Sizewell for around 30 years.

2.5 BNFL told the Committee that regular movements of spent nuclear fuel to Sellafield are essential, given the lack of storage facilities at the reactor sites. In general, enough spent fuel is generated at each reactor site to fill one transport flask per week but it is usual to stockpile the material until two flasks are filled, to make each journey more cost efficient and to reduce further the possibility of a transport accident.

2.6 It is then normal practice for three trains, from Dungeness, Bradwell and Sizewell respectively, to be marshalled at Willesden for subsequent transfer to Sellafield. There was an unwillingness to give exact figures for the number of transportations of spent nuclear fuel through London annually, though BNFL confirmed that no more than 50 trains a year departed from Sizewell to Sellafield. DRS echoed the evidence from BNFL, with some added qualifications, "We would expect there to be around one consignment per week from each of the three power stations in the South East. Operational factors mean that these figures are subject to some variation. DRS operates a flexible service that sometimes leads to the trains being marshalled. It is not possible to put an accurate figure on how many of these trains will be marshalled. Trains sometimes go straight through without marshalling, sometimes two trains are marshalled and sometimes three again depending on operational factors".[5]

[5] Communication from Peter O'Brien, DRS, to Committee

2.7 Each train from Willesden marshalling yards ordinarily consists of flasks from three distinct and previous trains. Assuming that the number of trains going to Willesden in a year is up to 150 and that up to 50 trains then leave Willesden, going north to Sellafield, we can estimate that there are up to 200 separate transportations of spent nuclear fuel through London per year.

2.8 It is clear that the spent nuclear fuel needs to be reprocessed or stored and that the only appropriate facilities currently available are at Sellafield. Nuclear waste is transported through London simply because the metropolis lies between the South East and Cumbria. All transportation of nuclear waste raises questions of safety and security, but such questions are particularly urgent and acute when they concern densely populated areas such as London. The European Parliament in the Report of the Committee on Regional Policy, Transport and Tourism published in February 2001 called "on all Member States … as far as possible, to avoid transit [of nuclear waste] through densely populated areas".[6]

2.9 Are there alternatives to transporting the South East's nuclear waste through London? We note that the European Parliament Committee also called on Members States "to apply the shortest possible distance principle to all shipments of nuclear material"[7] – a principle which, if applied to rail transport, would mean trains continuing through London. Clearly these are two desirable principles which have to be balanced against each other in order to arrive at a reasonable routing decision. Much of the evidence we heard considered whether it was possible to develop alternative routes for spent fuel and other freight around London.

2.10 Though there was some discussion during the scrutiny process of alternative methods of transporting nuclear waste, all responses and submissions to the scrutiny agreed that rail transport was probably the safest mode of transport for spent fuel when compared with road or sea.[8]

2.11 Whilst rail may well be the safest mode of transport for spent nuclear fuel in this country there remain important requirements for the safe transport of that fuel on the rail network. We were told that it was general practice to avoid tunnels and bridges where possible, to reduce the risk and minimise the severity of any accident. Movements were also scheduled so that trains with hazardous cargoes did not pass each other in a tunnel at the same time nor follow each other on the same line. Trains are not allowed to travel above 45 miles per hour. We support the 45 mph speed limit for trains transporting spent nuclear fuel and would be seriously concerned at any proposal to increase that limit.

2.12 Representatives of two London boroughs (Kensington and Chelsea, and Barnet) gave oral evidence strongly supporting moves aimed at development of an orbital freight rail route.[9] They were joined in these views by a written submission from Wandsworth Council.[10] Some witnesses suggested that less-densely populated areas should be preferred to more densely-populated ones, but others expressed concern at this

[6] European Parliament A5 0040/2001 p.8
[7] European Parliament A5 0040/2001 p.8
[8] Minutes of Evidence 15 March 2001 4.7, 26 March 2001 3.8
[9] Minutes of Evidence 26 March 2001 3.3 ff
[10] Wandsworth Council - Letter to the Committee dated 19 February 2001

suggestion, reminding the panel of the strong protests in Cricklewood when BNFL/DRS proposed moving their marshalling activities from Willesden.

2.13 DRS stressed that current routes were fully compliant with United Kingdom regulations. Railtrack told us that there had over the last few years been discussions on the possibility of developing both passenger and freight routes around London and that Railtrack was working with the authorities to develop London orbital railways. An orbital passenger rail route would most probably use existing parts of the network and be designed to link population centres. What is needed is consideration of orbital routes for freight which minimise journeys through populated areas.

2.14 In discussing the routing of trains around rather than through London we must be sensitive to a possible charge of nimbyism. But in fact local groups in London voicing concern over nearby marshalling of nuclear waste trains have made clear they do not want the problem simply to be moved to someone else's backyard. The issue of the transport and routing of spent nuclear fuel is being considered as part of a National Stakeholder Dialogue established by BNFL.[11] Furthermore, BNFL has made a commitment to undertake a review of transport operations in the South East after the removal of the final used fuel from Bradwell power station in 2005. In both these processes it is important that efforts be made to identify practicable routes which avoid centres of high population density.

2.15 There is a justifiable concern that, if nuclear waste is to be transported, it avoid as far as is possible densely populated areas, be it London or elsewhere. The possibility of the use of rail bypass routes to transport nuclear waste past London must be further explored. Freight bypass routes are obviously a matter which is broader than the nuclear waste issue alone. We do believe, however, that the desirability of nuclear waste trains avoiding London is an important incentive to further consideration by Railtrack and BNFL of such routes. **We recommend that Railtrack and BNFL report to the Assembly the conclusions of their consideration of possible freight bypass routes around London and their suitability for the transport of spent nuclear fuel.**

Future Transport Requirements and Routes

2.16 BNFL told us that they plan to shut down Bradwell in 2002 and both Dungeness 'A' and Sizewell 'A' in 2006. Nuclear Trains Action Group (NTAG) thought that the decommissioning of such power stations could increase the frequency of shipments of waste. BNFL did not expect the number of spent fuel shipments to increase during the three-year period of reactor de-fuelling. The same frequency of train would be maintained until the de-fuelling process had been completed. **We welcome the assurance from BNFL that there will be no increase in the frequency of transport of spent nuclear fuel during the decommissioning of Magnox power stations. We expect them to abide by this assurance.**

2.17 We note that the decommissioning of the three reactors is due to be completed in 2009. Although there will still be spent nuclear fuel produced by the AGRs in the South East, this will mean that the transport of spent nuclear fuel through London after 2009

[11] BNFL/DRS - Written Answers to Committee Questions

will be significantly reduced, subject to any decisions taken as a result of the Government's Energy Review.

2.18 The issue of nuclear waste trains must also be seen in the broader context of national energy policy. The Government has recently announced a wide-ranging Energy Review. There has been press speculation that the Review will recommend the building of new nuclear plants, if only to replace those due to be decommissioned. During the scrutiny process, the Committee was aware that it was outside its remit to consider the necessity of nuclear reactors. The comments contained in this Report should not, therefore, be read as endorsing any particular view in this regard. If, however, as part of its consideration of future energy options, the Energy Review considers the need for new nuclear capacity, it is important that the Review take account of the issue of the transport of spent nuclear fuel

2.19 New nuclear reactors could well have an impact on future transport planning in the South East. Any decisions on nuclear reactors in the South East would have to be made in conjunction with decisions on bypass routes, the possibility of extended on-site storage facilities, and the capacity of the network to carry the required number of shipments safely.

3. Accidents

Risk assessment

3.1 Spent nuclear fuel has been transported by rail in the United Kingdom since 1962 and during that time some 6 million miles have been travelled. DRS state that no incident involving the release of radioactivity has occurred during that period, a claim supported by DTLR, the National Radiological Protection Board (NRPB) and the Health and Safety Executive (HSE). The Committee welcomes this record. Any consideration of the transportation of spent nuclear fuel through London must, however, assess whether further measures can be taken to reduce the risk of accident and must determine what steps should reasonably be taken to secure public confidence in such transportation.

3.2 There have been past assessments undertaken by various authorities of the risk of a serious accident involving a spent fuel flask. The view of the industry and its regulators is that the likelihood of a serious accident involving a spent fuel flask is extremely small, and that any release of radioactive materials would be minor and take place slowly. After critical appraisal in the mid-1980s, this view was broadly endorsed by consultants to the GLC and by the Sizewell B Public Inquiry Inspector. The Campaign for Nuclear Disarmament (CND) and NTAG agreed that the likelihood of a serious accident was remote but believed that the consequences of such an accident could be catastrophic.[12]

3.3 The most recent accident risk assessments were undertaken by the NRPB under contract to BNFL and British Energy in 1999.[13] The purpose was to carry out assessments of the risks to emergency service personnel following nuclear accidents. Accident scenarios described by NRPB as "representative but fairly pessimistic" were developed. These included a Type B package accident scenario (for a Magnox flask), leading to a small proportion of the radioactive materials being released at a uniform rate over 84 hours.

3.4 Assessments of the radiation doses received by emergency personnel were made by considering three representative duties:

- an initial responder, 10 metres from the flask for 10 minutes with no special protection;
- an individual at the cordon distance for 1 hour with no special protection; and
- an individual 10 metres from the flask for 1 hour wearing full protective clothing and breathing apparatus.

3.5 The NRPB found that the highest dose would be received by the initial responder, with an effective dose of 0.0002 milliSievert (mSv). The NRPB points out that this dose is broadly equivalent to less than 1 day of exposure to background radiation, and would lead to a very small additional lifetime risk of cancer of about 1 in 2 million. The NRPB also states that while the assessment cannot be considered to involve a worst case scenario, it uses pessimistic assumptions about the quantities of radionuclide released in the accident.

[12] Minutes of Evidence 15 March 2001 4.10
[13] NRPB - M1044

3.6 Unsurprisingly, such official views have not succeeded in dispelling concern. In oral evidence CND argued that the possibility of an accident should not be dismissed as its consequences would be catastrophic, though they also acknowledged that the risks of such an accident were remote. NTAG argued that even if the risks were small the implications of an accident were immense. In its written submission, Greenpeace warned that "a train crash, fire or explosion, could cause a major nuclear accident and expose anyone living nearby to radioactivity".[14] They went on to say that "We do not know the likelihood of a serious nuclear transport accident. But we do know that the consequences could be severe". [15]

3.7 The consideration of risk has in recent years become a matter of political importance and some sensitivity. Bromley Council made the point succinctly, stating that used fuel transport by rail was a "very emotive issue for those residents affected" and that it was "difficult for those people to obtain an objective view of the risks involved, principally due to the fact that experts in this field are either employed by the nuclear industry, or speak from an environmental 'anti-nuclear' viewpoint".[16] Bromley submitted a report from their Environmental Services Committee which stated that the "lack of any proven risk does little to dim residents' concerns".[17] There were similar concerns in other London Boroughs as was clear when we took evidence from representatives of the Royal Borough of Kensington and Chelsea and the London Borough of Barnet. We were told that there was a need for a cross-London assessment of risk, carried out by an independent entity.[18]

3.8 It appears from our evidence that there are two related issues which need to be addressed in any risk assessment. One is the likelihood of a serious accident occurring. The other is the likely extent of radiation released in such an accident. It was apparent that these are important questions given the fact that the relevant emergency planning is based on the official assessment of these risks. DRS in oral evidence emphasised that previous public inquiries had considered the question of risk in detail and that this should give the public some confidence in the robustness of risk assessments. They did not consider that further risk assessments would add anything to the safety and integrity of DRS's operations. DRS risk assessment processes were laid down with the HSE and were UK-wide. DRS did admit that there might be a benefit of greater public confidence were there to be a London-specific risk assessment, though he insisted the current risk assessment process was sufficiently robust.[19]

3.9 The Environment Council provided written evidence of the value of a "Joint Fact-Finding Approach", pointing out that the adversarial nature of much scientific and technical debate can often hamper the resolution of issues. In the Joint Fact-Finding Approach "participants agree *who* should provide information about *what*, using which *assumptions* and detailing *how* they should do it as well as agreeing who should *pay*. This means that when the result of the agreed research, studies or investigations become available, attention is focussed on *what these mean and what should be done*

[14] Memorandum - Greenpeace
[15] Memorandum – Greenpeace
[16] Bromley Council - Letter to Committee 5 March 2001
[17] Bromley Council - Letter to Committee and attachment 15 February 2001
[18] Minutes of Evidence 26 March 2001 3.3, 3.5, 3.11
[19] Minutes of Evidence 17 May 2001 5.16

rather than on whether they are 'right'". [20] In oral evidence Steve Robinson, Chief Executive, The Environment Council, highlighted the potential of such an approach to resolve continuing disagreements over accident risk.[21]

3.10 We are concerned at the wide disagreement that exists over levels of risk from the transport of spent nuclear fuel through London, a disagreement which does nothing to encourage public confidence. We believe that there is value in having a technical and detailed risk assessment which is specific to London. Such a risk assessment might examine:

- the mechanisms of the release of radioactivity from the transport packages
- the accident scenarios which could lead to these releases
- the probabilities of such accident scenarios occurring in London
- the potential size and form of radiation releases
- the potential dispersal of radioactivity in London
- the possible consequences for London's environment, people and business

This would inform any review of emergency preparedness and accident liability arrangements, and provide a basis for public information.

3.11 We note that the approach pursued by the Environment Council of instituting a Joint Fact Finding Study has been useful in similar circumstances. This is an approach which should be positively considered in this case. It would be necessary to involve such stakeholders as the GLA, London Boroughs, the Emergency Services, BNFL, DRS, DTLR and some of the NGO participants in the debate, as well as representatives of community groups. A Steering Group of stakeholders would agree terms of reference, invitations to tender and any contracts. The cost of the Joint Fact Finding Study would be shared amongst stakeholders. We would expect terms of reference to cover the points listed above.

3.12 We recommend that a risk assessment be undertaken of the transport of spent nuclear fuel by rail through London, and that the Mayor initiate discussions with relevant bodies to establish such an assessment. This is a necessary precondition for effective procedures which inspire public confidence. We believe there may be value in a Joint Fact Finding Study undertaking this task and recommend that the Mayor consider the possibility of initiating and supporting such a process with other stakeholders.

Adequacy of Package Tests

3.13 The tests intended to ensure the integrity of spent fuel packages are found in United Kingdom legislation and are based on the relevant International Atomic Energy Authority (IAEA) Guidelines. The IAEA Transport Guidelines were originally established in 1961, and are updated on a regular basis so as to keep pace with scientific and technological developments. A significantly updated version, ST-1, was published in 1996 and then reissued, with only minor revisions, in 2000 as TS R-1. One of the most

[20] Memorandum – The Environment Council
[21] Minutes of Evidence 26 June 2001 5.23

significant changes in the 1996 revision was the requirement that a radiation protection plan be established for the transport of radioactive material.

3.14 The IAEA requirements do not have the force of law and have to be implemented in national regulations by the competent authorities of individual countries. The competent authority for all modes of transport in the United Kingdom is the Radioactive Material Transport Division (RMTD) of DTLR. The HSE is the body responsible for policy development and enforcement of regulations relating to carriage of radioactive material by rail.

3.15 In 1996 the European Union issued the RID Directive, aiming to harmonise regulations dealing with all types of waste transport, to coincide in particular with the publication of ST-1. The Amendments resulting from ST-1 were originally to come into force on 1 January 2003 but at a joint IAEA/EU meeting in June 2000 it was agreed to bring implementation in earlier, by 1 January 2002, following a six month transitional period. The HSE has made clear that the design of nuclear waste containers will always comply with or exceed the requirements of the current IAEA Guidelines. Consultation has just begun on changes necessary in regulations to comply with the new IAEA Guidelines.

3.16 Packages of radioactive materials are classified as either Type A or Type B packages. Type A packages are used for the transport of relatively small but significant quantities of radioactive material. They are limited in terms of the maximum amount of radionuclides that they can contain, as it is assumed that they would not withstand a serious accident. They are, however, expected to maintain their integrity during normal transport conditions, and are therefore subjected to tests simulating these. Type A packages are also used to transport items such as fresh nuclear fuel and radioisotopes used in medicine. Such material is routinely moved by road in the UK.

3.17 Type B packages, also known as "flasks", are used for the transport of highly radioactive materials. These purpose built containers are constructed from forged steel more than 30cm thick, each flask typically weighing more than 50 tonnes. They are 2.3 metres high and 2.2 metres by 2.5 metres wide. Each has a steel lid which is bolted down. Flasks usually contain not more than about two and a half tonnes of spent nuclear fuel.[22] They are expected to withstand much more rigorous conditions than Type A, and must undergo the following sequential tests:

- The Impact (Drop) Test; A 9m free fall onto an unyielding surface, intended to be equivalent to a crash into a concrete bridge abutment at 120 miles per hour
- The Penetration (Punch) Test; This involves allowing the container to fall 1m onto a steel rod 15cm in diameter
- The Fire Test; A 30-minute exposure at 800ºC that engulfs the entire container
- The Water Immersion Test; Submergence of that same container under 15m of water for eight hours, followed by subjecting it to a pressure equivalent of 200m immersion for one hour

3.18 NGOs criticised the inadequacy of both the drop and fire tests. With regard to the nine metre drop test, it was claimed that this was clearly inadequate given the fact that flasks routinely cross bridges higher than nine metres. BNFL, however, pointed out that the

[22] Memorandum - BNFL/DRS

nine metre drop test is more severe than might at first be thought because the flask is dropped onto an unyielding target, which does not absorb impact energy but reflects the force back into the container to cause maximum damage. These explanations did not convince NTAG who asked why not simply do a 30 metre drop onto an unyielding surface.[23]

3.19 On the fire test, NGOs pointed out that fires could burn at higher temperatures than 800°C, and for much longer. BNFL claimed that the fire test was sufficiently severe because it was a fully engulfing flame at 800°C. It was acknowledged by DRS, Railtrack and LFEPA that fire temperatures, particularly in tunnels, could significantly exceed 800°C but they emphasised that such temperatures were rare, highly localised and of short duration.[24]

3.20 As a result of improvements in computer modelling BNFL told the Committee that they had not followed the recommendations of the Sizewell B inquiry, to conduct tests on a full-scale flask. Instead, in compliance with IAEA Guidelines, the tests were carried out on third-scale and quarter-scale models, with results then upscaled. It must be stressed that current practice complies with IAEA Guidelines. However studies in the United States suggest that there is little public confidence in the adequacy of tests on reduced-scale models.[25] We share some of these concerns at an over-reliance on computer modelling. **We recommend that an assessment of the relevance of package tests to real accidents be included in the risk assessment recommended by the Committee.**

Trackside security, sabotage and terrorism

3.21 A serious concern raised in evidence was that of trackside security. This issue is not confined to the question of the transport of spent nuclear fuel but the possibility of damage to signalling equipment and rolling stock could have serious results in the case of shipments of potentially hazardous material such as nuclear waste. There is furthermore the issue of possible external irradiation and contamination of those trespassing.[26] NTAG claimed that trackside security was very poor and that access had been relatively easy to, for example, Hither Green, where nuclear trains used to be held in the past during busy rush hour periods.

3.22 NTAG also said that DRS had reduced the number of staff on their locomotives but this was denied by DRS in oral evidence, where they explained that the previous "guard" had simply been redesignated "railman" and that his/her role and responsibilities had remained unchanged.[27] **We are satisfied that there has been no reduction in the number of DRS personnel accompanying each train.**

3.23 The question of trackside security, and in particular the access children and young people might have to spent fuel wagons, is a matter of legitimate public concern, and one which goes much wider than the nuclear waste issue. This is an area where

[23] Minutes of Evidence 15 March 2001 4.12
[24] Minutes of Evidence 26 June 2001 5.20
[25] Ammerman D J et al June 2000: Spent nuclear fuel transportation package performance study, Issues report. Report to US Regulatory Commission
[26] We do not discuss here such obvious hazards to children as being struck by a passing train
[27] Minutes of Evidence 17 May 2001 5.18

Railtrack and DRS have an obligation to interact with public interest groups in order to recognise their concerns and be seen to make positive efforts to allay them. **We recommend that Railtrack and DRS, along with other operators, hold talks with local interest groups on the improvement of trackside security, and include specific consideration of access to spent fuel flasks.**

3.24 It is not only trespassers who can cause accidents through damage to the railway. There is also the possibility of more deliberate sabotage or terrorism. There has been debate on this issue in the past. In 1984 consultants to the then GLC provisionally concluded that sabotage attack could lead to greater risks than those from reasonably foreseen accidents and that this required further study. Later public inquiries, however, both over Sizewell B and Hinkley Point C concluded that a spent fuel flask was not a promising target and that the probability of sabotage could not usefully be estimated.

3.25 In written evidence to the Committee Greenpeace argued that terrorists would find spent nuclear fuel flasks an attractive target, disagreeing with the official position.[28] Similar concerns were raised by NTAG and KARE[29], and by Barnet Council and Kensington and Chelsea Council.[30] CND believed that securing the spent fuel transport system effectively was impossible.[31] DRS did not consider there to be a credible terrorist risk on the basis of arrangements agreed with the Government on such risk assessment. DRS declined to elaborate on this judgement "for obvious reasons".

3.26 It is difficult to discuss such sensitive matters in a public forum. Before the recent terrorist attacks there had already been public discussion in the United States of the terrorist threat to spent fuel packages. In particular, it was accepted that credible sabotage events involving the use of high energy explosive devices could penetrate a spent fuel package, leading to the dispersal of radioactivity into the environment. But there had been disagreement amongst USA stakeholders about the potential scale of releases and how package performance studies should take into account sabotage events.[32]

3.27 In the aftermath of the attacks in the United States it is now necessary for the risks of sabotage or terrorist attack against spent nuclear fuel transport to be reassessed. **We believe that any London-based risk assessment should include consideration of the risk from sabotage or terrorist attack.**

Emergency preparedness

3.28 Emergency arrangements relevant to responses to incidents involving spent fuel transport by rail are set out in three main documents:

- RADSAFE - this national industry plan is primarily about securing expert advice to the emergency services following an incident involving the transport of radioactive materials.

[28] Memorandum - Greenpeace
[29] Minutes of Evidence 15 March 2001 4.14-15
[30] Minutes of Evidence 26 March 2001 3.12
[31] Minutes of Evidence 26 March 2001 4.15
[32] State of Nevada 1999: Petition to Nuclear Regulatory Commission for the amendment of the physical protection regulations contained in 10 C.F.R.73.June 1999

- LESLP Manual - this London-based emergency services manual describes joint procedures for securing a coordinated response to major incidents of all types. It also describes emergency service roles and responsibilities at a major incident. The joint procedures build upon the procedures established by each emergency service.
- Arrangements for Public Information in Radiation Emergencies - this handbook produced by LFEPA describes arrangements for supplying information to members of the public affected by a radiation emergency.

3.29 Incident response arrangements are based on the official view that any release of radioactive materials following an accident involving a spent fuel flask would be minor and take place slowly, thereby allowing time for an effective emergency response. We identify below the main concerns raised in evidence on emergency preparedness, together with the responses of the emergency services.

RADSAFE

3.30 RADSAFE is a single co-ordinated transport emergency plan for Great Britain in the event of an accident involving a fuel flask. It has evolved from previously existing plans. The aim is to provide expert assistance to the emergency services, with early information at the scene of the event and technical support within a target time.[33] The RADSAFE plan also provides for a single 24 hour telephone number, together with media support and clear-up guidance. Were there to be an incident the first phase of the plan is to get proper advice to relevant persons at the site and the second phase is to get the response team to the site.

3.31 It is important that London's emergency services are fully trained in RADSAFE processes. There are RADSAFE training courses to which the emergency services are invited and there are also RADSAFE exercises which simulate an emergency so as to test and practise response.

3.32 It was proposed during the course of the evidentiary hearing with local authority representatives that a London-based RADSAFE exercise be held. We were surprised and concerned to learn that none has as yet taken place. London must be the most extended stretch of high density urban space through which the nuclear waste trains pass and we believe it to be essential that a RADSAFE exercise take place in this environment. DRS saw no reason why such a London-based exercise should not be organised and the proposal was enthusiastically supported by the local authority representatives who gave oral evidence to the Committee. The emergency services told us that they would be keen to participate in a London-based RADSAFE exercise.[34]

3.33 It is important that all stakeholders are fully acquainted with the RADSAFE provisions. We were concerned to note that two organisations in giving evidence to the Committee still referred to the predecessor schemes to RADSAFE. BNFL told us that they had made presentations on RADSAFE to the London Emergency Planning Forum (LEPF) and that subsequently all members of the LEPF board had been invited to attend RADSAFE training. Once the date of the next RADSAFE exercise had been determined, the London emergency services would be invited to attend.

[33] Memorandum – BNFL/DRS
[34] Minutes of Evidence 26 June 2001 5.7

3.34 We were concerned to learn from the emergency services that only LFEPA officers had attended RADSAFE training. Representatives of the Metropolitan Police, the London Ambulance NHS Trust and the British Transport Police all said that they had not attended a RADSAFE course because in the event of such an emergency they would all take direction from the fire service. Whilst training for fire officers is paramount, we believe that all the emergency services should send relevant officers on the course rather than relying solely on one of the services having the appropriately trained staff in place at the right time.

3.35 CND, NTAG and KARE all cast doubt on the effectiveness of current emergency preparedness. NTAG considered the RADSAFE target response times to be inadequate, this judgement stemming in part from a disagreement as to the likely seriousness of the effects of an accident.[35]

3.36 Emergency service witnesses said that the response times specified in RADSAFE for the delivery of expert advice are reasonable. The Fire Brigade has its own radiation monitoring equipment and would aim to have initiated monitoring 15 minutes into an incident. The Fire Brigade's attending Scientific Officer would advise on any early action that should be taken. Subsequent action would be informed by expert advice provided under the RADSAFE scheme. Brigade Hazmat Officers receive appropriate training at the Fire Services College. The police and ambulance services would rely on advice from the Fire Brigade in the immediate response phase. For this reason, police and ambulance officers do not receive the same level of training.

3.37 We were told that the planned cordon control at 45 metres is small compared with the response to other types of incident, such as chemical fires or building collapse. However, the cordon position could be adjusted in the light of radiation monitoring results and subsequent advice.[36]

Public Information

3.38 In general CND, NTAG and KARE considered the public poorly informed about emergency preparedness, although they agreed that the provision of public information needed to be handled carefully so as to avoid alarm. The emergency services also stated that any provision of information to the public about accident risks and emergency arrangements should seek to avoid generating unnecessary concern or alarm.

3.39 Kensington and Chelsea referred to potential difficulties arising from large numbers of people evacuating areas without any organisation or guidance, the need for clear protocols for dealing with the press, and for public access to reliable information.

3.40 The emergency services told us that a joint briefing of incident commanders could declare a Major Incident if circumstances required it, for example for evacuation or media interest reasons. The police would co-ordinate the media response, with an emphasis on early and accurate information in order to encourage an appropriate public response. It was normal practice for the police to handle evacuation. Spontaneous movements of people away from emergency incidents were not unique to radiation emergencies and the police often face this challenge. Plans are sufficiently flexible to

[35] Minutes of Evidence 15 March 2001 4.16
[36] Minutes of Evidence 26 June 2001 5.5

respond to an incident as it develops, including accidents larger than those currently anticipated.

3.41 LFEPA has advised the Boroughs to plan for Radiation Helplines. The LAS also envisages a role for local health authorities. Consistency of advice given to the public would be key. It was not known how many Boroughs have responded to the LFEPA advice. We believe that the provision of effective, prompt and trustworthy advice to the public in the event of an accident is crucial. Londoners need to be confident that public information provision, including helplines and proper training for staff, is not just a plan on paper but fully implemented and tested by all local authorities and emergency services.

3.42 The UK Nuclear Free Local Authorities (UKNFLA) argued for the introduction of a statutory obligation on local authorities to prepare and exercise plans for a spent fuel transport accident. The emergency services considered the statutory basis of emergency planning to be adequate. The emergency services would not want to see any new statutory obligations on local authorities that were outside existing LESLP procedures.[37]

3.43 Barnet and UKNFLA argued for advance notification of transport. The emergency services said that there are no convincing reasons for advance notification of transports. There is an argument against prior notification if information found its way to people with criminal or terrorist motives. We do not find that a convincing case has been made for the advance notice of spent fuel transports nor for a new statutory obligation on local authorities to plan for spent fuel transport accidents.

3.44 On the basis of the evidence received we have come to the view that more needs to be done to ensure that emergency procedures in London are fully and widely known and that they are suitably robust.

3.45 We recommend:

- The organisation by the RADSAFE Committee of a London-based RADSAFE exercise
- That BNFL should reissue an invitation to all members of the London Emergency Planning Forum to attend RADSAFE training
- A review by the Emergency Services and the Boroughs of those elements of emergency preparedness which take specific account of radiation incidents, for example the setting up by the Boroughs of radiation helplines, mechanisms for ensuring consistency of helpline advice and the training of helpline staff
- A review by the Emergency Services of whether current arrangements can be extended to provide an effective response to any accident more serious than those officially anticipated

3.46 The last of the above recommendations should be implemented as soon as the results of the proposed London-based risk assessment are known. Only then will we have a sense of what can reasonably be expected of the emergency services in preparedness for severe radiation incidents.

[37] Minutes of Evidence 26 June 2001 5.10-13

Accident liability

3.47 Compensation is payable by the nuclear operator in the event of an accident which causes injury or damage to property. It is limited in total amount to about £300 million. BNFL stated that in the highly unlikely event of an incident leading to contamination of property or persons, BNFL would be liable to provide up to £140 million to cover claims where damage was proven. The Government could be required to make available further funds of up to £160 million. Some witnesses claimed that the amount available was clearly inadequate. The UKNFLA said that most clean-up estimates were for sparsely populated areas and compensation arrangements wrongly demanded that the claimant be able to prove cause and effect.[38]

3.48 Kensington and Chelsea Council said that any comment on the adequacy of compensation arrangements should wait on the outcome of the proposed London-based risk assessment. We agree with this view. Therefore **we recommend that after a London-based risk assessment has been completed, the compensation available in the event of an accident be reviewed by the Government and BNFL in the light of the risk assessment findings.**

[38] Minutes of Evidence 26 March 2001 3.16

4. Contamination

The risk of contamination of transport containers

4.1 A further area of concern over the transport of spent nuclear fuel is the possibility of contamination. This applies in the first instance to the flasks themselves, but then also to the trackside and staff. Radioactive material is transported in containers considered appropriate to the type and amount of radioactive material concerned, in keeping with IAEA Guidelines. Apart from the possibility of accidents resulting in release of radioactive material from inside the container, trackside contamination can occur as a result of contamination on the outside of the container.

4.2 There is a general acceptance that contamination of the outside of the transport package can occur at the place of loading, which could then spread to the trackside. In the case of AGR and Magnox reactors, spent fuel is stored in cooling ponds for not less than 90 days prior to transfer to transport flasks. The pool water tends to be slightly contaminated and some of this may become attached to flask surfaces during fuel transfer, especially where this takes place wholly underwater. Such contamination that does take place can either be relatively fixed onto surfaces, or be more readily removed, i.e. non-fixed.

4.3 There have been cases where contamination monitored on flasks has exceeded the internationally agreed limit of 4 Bq/cm^2 (known as the Derived Working Level or 'DWL'). The discovery of contamination in 1998 at a marshalling yard in Valognes in northern France resulted in temporary suspension of all spent fuel shipments in France, Germany and Switzerland. As well as trackside contamination, it was disclosed that as many as 20% of spent fuel transport casks used to ship material to the COGEMA reprocessing facility at Cap de la Hague between 1988 and 1998 were known to have exhibited non-fixed contamination in excess of the limit. Transports were only resumed following adoption of a number of stringent monitoring and reporting protocols. No similar suspension took place in the UK, as the long-term monitoring results did not show similar elevated trackside levels and/or flask contamination.

4.4 It became apparent from subsequent investigations in France and other countries that the contamination, which can be fixed or hidden at the time of consignment, could be loosened or dislodged during the period of transport.[39] Such contamination as was found was not considered to be as a result of the failure of containment integrity of the package, but a failure of the monitoring process or failure to recognise the scope for fixed contamination to become non-fixed.

4.5 Two potential sources of this contamination have been identified:

- Sweating

This process is well known, and its causes are generally understood. It was described in a joint report by a number of national regulatory agencies in 1998 as "A transformation of formerly fixed contamination on the surface of the flask - which in this form cannot be discovered by smear tests during the outgoing inspection in the nuclear power plant -

[39] Pertius V., 2000 'Surface Contamination of Spent Fuel Convoys: Resumption of Transport in France' RAMTRANS Vol 11 Nos 1-2 pp.183-188

to non-fixed (removable by wiping) contamination which on renewed smear sampling, e.g. upon arrival at the reprocessing plant, can be detected".[40]

4.6 During a journey flasks can be exposed to changes in atmospheric conditions, such as air temperature or humidity and small amounts of contaminated water can pass through the paint on the outside of the flask. It is obviously not possible to identify this form of contamination at the beginning of a journey.

- Hide-out

4.7 The 1998 joint report described this associated phenomenon as "The escape of residual amounts of contaminated pond water from pores, connecting gaps and cavities … or the dislodgement of radioactive particulate that has settled in areas that are difficult to decontaminate e.g. cavities, crevices, gaps, joints, etc. Release of droplets or a dislodgement of deposited larger particles as a result of thermal and mechanical effects during the shipment may lead to localised surface contamination (hot spots) on the flask or in the well area of the transport wagon lying below".[41]

4.8 Witnesses explained how they attempted to minimise the possibility of container contamination. BNFL told the Committee that at some reactors (Dungeness, for example) fuel transfer takes place wholly under water and so any contamination in the water can potentially contaminate the flask surface. At other reactors (Sizewell, for example), the transfer takes place outside of the cooling pond, thereby reducing the potential for contamination.[42]

4.9 DRS explained that it is now standard practice to enclose each flask inside a lockable cover before departure from the reactor railhead. There is then no access to the surface of the flask. This provides an extra level of containment so that even if the flask is contaminated on the outside, the lockable cover prevents the wider spread of contamination en route to Sellafield, where a further full suite of swab tests is carried out.[43]

4.10 DRS will not accept any flask for transport that demonstrates a level above 2 Bq/cm^2. Any such flask is cleaned and re-tested until it complies. Regular checks are made before flask filling and afterwards, by means of up to 60 individual swab tests.

The risk of contamination of trackside

4.11 The monitoring of flasks described above takes place before and after transport. BNFL told us, “Monitoring does not take place during transport as flasks are not accessible”. They went on to state that “Personnel, vehicles, contact points and marshalling yards are independently monitored (by Scientifics Ltd). BNFL and DRS are satisfied with monitoring procedures”.[44] We were told that the monitoring regime includes Railtrack property.[45]

[40] Competent Authorities 1998 ‘Surface Contamination of Nuclear Spent Fuel Transports: Common report of the Competent Authorities of France, Germany, Switzerland and the UK’ October 1998
[41] Competent Authorities 1998 ‘Surface Contamination of Nuclear Spent Fuel Transports: Common report of the Competent Authorities of France, Germany, Switzerland and the UK’ October 1998
[42] Memo - BNFL
[43] Memo – BNFL; Minutes of Evidence 17 May 2001
[44] BNFL/DRS Written Answers to Committee Questions
[45] BNFL/DRS Written Answers to Committee Questions

4.12 DRS told the Committee that there was a comprehensive monitoring regime for regular staff. There had to date been no radiological records arising from such tests on staff involved in the rail transport of spent nuclear fuel.[46] We were also told that the monitoring of transportation (which had been undertaken since the start of the rail service) had never identified an occurrence of contamination on the external, accessible parts of any vehicle.[47]

4.13 Whilst CND referred to a number of incidents of trackside contamination around the country,[48] none of them in London, BNFL stated that all the incidents took place before the establishment of DRS in 1995 and the introduction of lockable covers.[49] The issue of the monitoring of railheads and marshalling yards is also being considered as part of the Jointly Agreed Sampling and Monitoring Working Group, which we discuss below.

Recent instances of flask contamination above agreed limits

4.14 We cite below recent instances where monitored contamination has exceeded the approved limit. We note that problems can arise in assessing the level of contamination from these swab tests, in that they are assumed to only remove around 10% of the non-fixed contamination present, whereas in practice the amount removed can be considerably higher. It is therefore possible to overestimate the level by up to a factor of ten.[50] It can also result in underestimation of the contamination levels, if the swabbing process fails to detect non-fixed contamination which is nevertheless present.

4.15 In a Parliamentary Answer on 10 June 1998, the then Transport Minister stated that between January 1995 and April 1998, 11 flasks had arrived at Sellafield from UK power stations with in excess of 1 DWL, and 42 empty flasks had arrived at power stations with similar levels of contamination. Four incidents involved more than 10 DWLs.

4.16 A further survey examining spent fuel shipment casks in the UK was prepared for the then DETR in 1999 by NUKEM Nuclear Limited. Twenty different sites were visited and only one instance (at a site in Bridgewater, Somerset) was reported of non-fixed contamination being measured in excess of the DWL.[51] Concerns were expressed by some environmental groups and members of the public as to the independence of this report.

4.17 More recently, monitoring carried out by another organisation for DETR of four AGR and six Magnox flasks at Sellafield showed slightly elevated levels on two of the AGR flasks.[52]

4.18 Annual reports are also issued by NRPB reviewing incidents involving contamination throughout the nuclear transportation industry, including rail. The latest of these, covering 1999, was published in March 2001.[53] It reports four separate occasions when loaded fuel flasks were found to have levels of contamination in excess of guidance limits after transport to "another nuclear site" (presumably Sellafield). The maximum

[46] Minutes of Evidence 17 May 2001 5.3
[47] Minutes of Evidence 17 May 5.4
[48] Memorandum - CND; Minutes of Evidence 15 March 2001 4.9
[49] Minutes of Evidence 17 May 2001 5.4
[50] NRPB – M1256
[51] NUKEM 1999: 'DETR Survey of RAM Transport Packages' Issue A March 1999
[52] NSG Environmental Ltd 2000 'Radiological Surveys of Irradiated Fuel Casks at BNFL Sellafield' October 2000
[53] NRPB – M1256

level recorded was 15 DWLs (i.e. up to 60 Bq/cm^2), but this should be read with the caveat referred to above regarding possible over-estimation of activity.

4.19 The instances of contamination of flasks above the DWL are a matter of concern to the Committee. It is important that work continues to detect and reduce the frequency of such incidents.

4.20 We must also consider whether contamination poses a threat to the public as the trains pass through London. The NUKEM report, referred to above, identified evidence for sweating and hideout-derived contamination on a number of flasks. Investigations were carried out regarding the radiation doses to workers that may have arisen, and the contamination of the public environment and doses to members of the public. Potential exposure was described as "significantly lower than current statutory dose limits".[54] We mention again the doubts expressed by certain groups such as CND over the independence of that report. NRPB perform regular reviews of the potential impact of transport of nuclear material on workers and the general public. Their studies have never concluded that radiation levels arising from rail transport of spent nuclear fuel have posed a significant threat to health. NTAG claimed that low-level contamination over time is as significant as high-level contamination in its possible effects.[55] The proposed London-based risk assessment should help resolve some of these disputes.

Independent monitoring

4.21 It is vitally important that there be regular monitoring of the potential contamination of the spent nuclear fuel flasks. DRS has to operate within the provisions and constraints of the relevant Railway Safety Case and this includes the requirement that appropriate monitoring arrangements are in place to comply with staff and Health and Safety regulations. The Safety Case also specifies the necessity in certain circumstances of controlled or supervised areas, especially during marshalling operations. DRS has never been cited by Railtrack for non-compliance with aspects of the Safety Case though apparently Railtrack have frequently cited other rail companies.

4.22 It is right that the first obligation to monitor radiation levels must rest with the transport company, DRS. And we are pleased to note that there have not as yet been any citations against DRS for breach of the Safety Case. There is also a need for independent monitoring of shipments, trackside and trackbed by those bodies with regulatory responsibility. The HSE shares responsibility for the routine inspection of shipments with the Radioactive Material Transport Division of DTLR. Inspectors can check and audit compliance with the Safety Cases at any time or place. DRS described such audits as a "regular event" but in fact there had been only one such visit to their offices in 2000 and no radiological review had been carried out.[56]

4.23 Railtrack also has a responsibility for the health and safety of both its workforce and passengers on the rail network. Railtrack told the Committee that they initially rely on DRS's controls and monitoring when it comes to the potential contamination of the flasks. They retain an independent specialist contractor who can be called on to carry

[54] NUKEM 1999: 'DETR Survey of RAM Transport Packages' Issue A March 1999
[55] Minutes of Evidence 15 March 2001 4.9
[56] Minutes of Evidence 17 May 2001 5.9

out parallel testing if required. The contractor is called in on an exceptional rather than a regular basis.[57]

4.24 The Committee was disappointed that the HSE, NRPB and DTLR all declined to give oral evidence to the investigation – especially as criticism was made by witnesses of the rigour of their inspection procedures. **We recommend that the Assembly continue to press for civil servants to provide oral evidence to Assembly committees when this is necessary for the proper conduct of investigations.**

4.25 The evidence suggests that the regulatory authorities (DTLR , the HSE and Railtrack) appear for the most part to rely on the monitoring commissioned by DRS and BNFL. The Committee views this as unsatisfactory. DTLR and the HSE have responsibility to ensure the train operators comply with the regulations and that there is no significant contamination as a result of the transport of spent nuclear fuel. They should be diligently using their powers of spot checking to ensure regulations regarding contamination of flasks, rolling stock and trackbed are within legal limits. **We recommend that DTLR, HSE and Railtrack adopt a proactive programme for the independent inspection of radiation and contamination levels of train and trackside.**

Further work on monitoring and transport safety

4.26 The nuclear energy industry does not consider the transport of spent fuel to pose a significant risk to public health. The issue remains, however, one of great concern to many members of the public, particularly those living and working near the transport routes. There has recently been an important attempt to meet such concerns in what has been called the "Cricklewood Dialogue". In 1998, at about the time of the events in France, DRS announced its intention to switch its train marshalling activities from Willesden to Cricklewood. There was intense local opposition. BNFL and DRS approached the Environment Council, an independent mediating agency, and asked it to organise a methodology whereby the conflict could be addressed. This resulted in the Cricklewood Dialogue, involving a broad range of stakeholders. An Agreed Resolution was issued in March 2000 which recommended that the move to Cricklewood should not take place. It also established the Jointly Agreed Sampling and Monitoring Project (JASM). The first phase of JASM has been reported to the management group. **We hope that the Jointly Agreed Sampling and Monitoring Project will point the way to a monitoring system which can enjoy the confidence of all sides in the nuclear energy debate and of local communities near to relevant transport routes.**

4.27 DTLR told us that they are scheduling a future review to examine the transport of radioactive material by road and rail, and they invited the GLA to be involved.[58]

4.28 **We recommend that the GLA respond positively to the DTLR invitation to be involved in the forthcoming review of road and rail transport of radioactive material.** This offers the GLA the opportunity to represent the concerns of Londoners and follow up matters raised in this Report.

[57] Minutes of Evidence 17 May 2001 5.7
[58] Memorandum - DTLR

Annex A

Summary of Conclusions and Recommendations

(square brackets indicate action point and relevant body)

1. We support the 45 mph speed limit for trains transporting spent nuclear fuel and would be seriously concerned at any proposal to increase that limit. (Para. 2.11)

2. We recommend that Railtrack and BNFL report to the Assembly the conclusions of their consideration of possible freight bypass routes around London and their suitability for the transport of spent nuclear fuel. (Para. 2.15) [Action: Railtrack and BNFL]

3. We welcome the assurance from BNFL that there will be no increase in the frequency of transport of spent nuclear fuel during the decommissioning of Magnox powerstations. We expect them to abide by this assurance. (Para. 2.16)

4. During the scrutiny process, the Committee was aware that it was outside its remit to consider the necessity of nuclear reactors. The comments contained in this Report should not, therefore, be read as endorsing any particular view in this regard. If, however, as part of its consideration of future energy options, the Energy Review does consider the need for new nuclear capacity, it is important that the Review take account of the issue of the transport of spent nuclear fuel. (Para. 2.18) [Action: Performance & Innovation Unit, Cabinet Office]

5. New nuclear reactors could well have an impact on future transport planning in the South East. Any decisions on nuclear reactors in the South East would have to be made in conjunction with decisions on bypass routes, the possibility of extended on-site storage facilities, and the capacity of the network to carry the required number of shipments safely. (Para. 2.19) [Action: Performance & Innovation Unit, Cabinet Office]

6. We recommend that a risk assessment be undertaken of the transport of spent nuclear fuel by rail through London, and that the Mayor initiate discussions with relevant bodies to establish such an assessment. This is a necessary precondition for effective procedures which inspire public confidence. We believe there may be value in a Joint Fact Finding Study undertaking this task and recommend that the Mayor consider the possibility of initiating and supporting such a process with other stakeholders. (Para. 3.12) [Action: Mayor and relevant stakeholders]

7. We recommend that an assessment of the relevance of package tests to real accidents be included in the risk assessment recommended by the Committee. (Para. 3.20) [Action: Mayor and relevant stakeholders]

8. We are satisfied that there has been no reduction in the number of DRS personnel accompanying each train. (Para. 3.22)

9. We recommend that Railtrack and DRS, along with other operators, hold talks with local interest groups on the improvement of trackside security, and include specific consideration of access to spent fuel flasks. (Para. 3.23) [Action: Railtrack and DRS]

10. We believe that any London-based risk assessment should include consideration of the risk from sabotage or terrorist attack. (Para. 3.27) [Action: Mayor and relevant stakeholders]

11. We were concerned to learn from the emergency services that only LFEPA officers had attended RADSAFE training. (Para. 3.34)

12. We do not find that a convincing case has been made for the advance notice of spent fuel transports nor for a new statutory obligation on local authorities to plan for spent fuel transport accidents. (Para. 3.43)

13. We recommend that the RADSAFE Committee should organise a London-based RADSAFE exercise. (Para. 3.45) [Action: RADSAFE Committee]

14. We recommend that BNFL should reissue an invitation to all members of the London Emergency Planning Forum to attend RADSAFE training. (Para. 3.45) [Action: BNFL and Emergency Services]

15. We recommend a review by the Emergency Services and the Boroughs of those elements of emergency preparedness which take specific account of radiation incidents, for example the setting up by the Boroughs of radiation helplines, mechanisms for ensuring consistency of helpline advice and the training of helpline staff. (Para. 3.45) [Action: Boroughs and Emergency Services]

16. We recommend a review by the Emergency Services of whether current arrangements can be extended to provide an effective response to any accident more serious than those officially anticipated. (Para. 3.45) [Action: Emergency Services]

17. We recommend that after a London-based risk assessment has been completed, the compensation available in the event of an accident be reviewed by the Government and BNFL in the light of the risk assessment findings.
(Para. 3.48) [Action: DTLR and BNFL]

18. The instances of contamination of flasks above the DWL are a matter of concern to the Committee. It is important that work continues to detect and reduce the frequency of such incidents. (Para. 4.19) [Action: BNFL, DRS, NRPB]

19. We recommend that the Assembly continue to press for civil servants to provide oral evidence to Assembly committees when this is necessary for the proper conduct of investigations. (Para. 4.24) [Action: London Assembly]

20. We recommend that DTLR, HSE and Railtrack adopt a proactive programme for the independent inspection of radiation and contamination levels of train and trackside. (Para. 4.25) [Action: DTLR, HSE and Railtrack]

21. We hope that the Jointly Agreed Sampling and Monitoring Project will point the way to a monitoring system which can enjoy the confidence of all sides in the nuclear energy debate and of local communities near to relevant transport routes. (Para. 4.26)

22. We recommend that the GLA respond positively to the DTLR invitation to be involved in the forthcoming review of road and rail transport of radioactive material. (Para. 4.28) [Action: Mayor/GLA]

Annex B

Evidentiary hearings, site visit and written evidence

Evidentiary Hearing 1, 15 March 2001
Witnesses:
Patrick van den Bulch - Campaign for Nuclear Disarmament (London Region)
David Polden - Nuclear Trains Action Group
Barrie Botley - Kent Against a Radioactive Environment

Evidentiary Hearing 2, 26 March 2001
Witnesses:
Jamie Woolley - Solicitor's Office, UK Nuclear Free Local Authorities
Guy Dennington - Environmental Services, Royal Borough of Kensington & Chelsea
David Norton - Environmental Services, London Borough of Barnet

Evidentiary Hearing 3, 17 May 2001
Witnesses:
Captain Malcolm Miller - Head of Operations, Transport Division, British Nuclear Fuels Limited (BNFL)
Neil McNicholas - Managing Director, Direct Rail Services (DRS)
John Abbott - Director of Assurance and Safety, Railtrack

Evidentiary Hearing 4, 26 June 2001
Witnesses:
Chief Superintendent Steve French - Metropolitan Police Service
Inspector Philip Trendall - British Transport Police
Roy Bishop - Director of Fire & Community Safety, London Fire & Emergency Planning Authority (LFEPA)
Tony Rowe - Senior Emergency Planning Manager, London Ambulance Service NHS Trust
Steve Robinson - Chief Executive, Environment Council

The minutes from the above evidentiary hearings can be found on the GLA web-site www.london.gov.uk/assembly/nwtmtgs/index.htm.

Site Visit, 21 June 2001

The Committee visited BNFL's Sizewell A Power Station. The tour included the fuel storage pond flask preparation and monitoring area and the railhead where flasks are loaded onto the trains.

Written Evidence

Written evidence was received from the following organisations and members of the public:

Barnet Council
British Nuclear Fuels Limited
British Transport Police
Bromley Council
Camden Council
Campaign for Nuclear Disarmament (Harrow & District Office)
Campaign for Nuclear Disarmament (London Regional Office)
Department for the Environment, Transport & the Regions (now Department for Transport, Local Government & the Regions)
Direct Rail Services Limited
Elsham Road Residents Group
Environment Council
Fire Brigade Union
Greenpeace
Cllr Gerry Harrison - London Borough of Camden
Health & Safety Executive
Herne Hill Society
Kensington and Chelsea Council
Kent Against a Radioactive Environment
Lambeth Council
London Ambulance Service
London Fire Brigade
Metropolitan Police Federation
Metropolitan Police Service
National Radiation Protection Board
Nuclear Trains Action Group
Railtrack
Sarah McCarthy (member of the public)
Scottish Green Party
Bob Smith (member of the public)
South End Green Association
Strategic Rail Authority
UK Nuclear Free Local Authorities
Dr Rudi Vis MP
Wandsworth Council
West Hampstead Amenity Transport
Whitefield Estate Residents Association
Mrs I Wilcox (member of the public)

Copies of the written evidence that we have gathered during the course of this investigation can be inspected by the public during normal office hours at the GLA Offices, Romney House, Marsham Street, London SW1P 3PY. Contact: Richard Davies, Assistant Scrutiny Manager, on 0207 983 4199.

Annex C

Glossary of terms used in this Report

A glossary of terms used in radiation protection is provided by the NRPB at http://www.nrpb.com/understanding_radiation/glossary/glossary.htm

The explanations of the terms provided below are largely based on the International Atomic Energy Agency glossary, with the exception of terms defined in UK regulations and guidance (HMSO Cm 2919[59]).

AGR	Advanced Gas Cooled Reactor – The second generation of nuclear reactors built in the UK. Uses slightly enriched uranium dioxide clad in stainless steel as fuel.
Bq	A unit which measures the activity of a radioactive source. One Becquerel (Bq) is the activity of a quantity of radioactive material in which one nucleus decays per second.
Contamination	Radioactive substances on surfaces, or within solids, liquids or gases (including the human body), where their presence is unintended or undesirable, or the process giving rise to their presence in such places. The presence of a radioactive substance on a surface in quantities in excess of 0.4 Bq/cm2 for beta and gamma emitters and low toxicity alpha emitters, or 0.04 Bq/cm2 for all other alpha emitters.
Decommissioning	Administrative and technical actions taken to allow the removal of some or all of the regulatory controls from a facility (in this case a nuclear reactor).
Derived Limits	A limit on a measurable quantity set, on the basis of a model, such that compliance with the derived limit may be assumed to ensure compliance with a primary limit.
Dose	A measure of the radiation received. Measured in units of sieverts, but see millisievert below.

[59] HMSO Command 2919: Review of Radioactive Waste Management Policy, 1995

Extended Irradiation	An extended period of the process of irradiation or the state of being irradiated (to irradiate is to subject with light or other electromagnetic radiation or with beams of particles).
Flasks	The vessel into which the waste form is placed for handling, transport, storage and/or eventual disposal; also the outer barrier protecting the waste from external intrusions.
Hazardous Substances	Substances, other than radioactive, that are dangerous due to their carcinogenic, corrosive, ecotoxic, explosive, flammable, harmful, infectious, irritant, mutanogenic, oxidising, or toxic characteristics.
Hazmat Brigade Officer	Specially trained fire officers to deal with incidents involving hazardous material.
ISO 9002	The quality assurance model for an organisation which does not carry out design and development. DRS is certified to this International Organisation Standard.
Magnox	The first generation of gas cooled nuclear reactors used for electricity generation at power stations constructed in the UK in the 1960s. Takes its name from the magnesium-based alloy in which the natural uranium metal fuel is contained.
MilliSievert	A unit of dose equal to a 1000th of a Sievert (the SI unit of equivalent dose and effective dose).
Nimbyism	The act or process of promoting the Not In My Back Yard sentiment opposing local development of a controversial facility
PWR	Pressurised Water Reactor – the most recent type of reactor to be constructed in the UK; water-cooled and moderated. Uses slightly enriched uranium dioxide clad in zircalloy as a fuel.

Radiation	The term radiation is commonly used to refer only to ionising radiation. Ionising radiation for the purposes of radiation protection, is radiation capable of producing ion pairs in biological material(s).
Radioactive Material	Material designated in national law or by a regulatory body as being subject to regulatory control because of its radioactivity.
Radioactivity	The process of spontaneous random disintegration of atoms, usually accompanied by the emission of energy in the form of ionising radiation. Sometimes used to mean the radioactive atoms or radioactive material itself.
Radioisotope	Not all atoms of the same element have the same mass. These are then referred to as different isotopes of the same element. If an isotope is also radioactive (see radioactivity), then it is called a radioisotope.
Radionuclide	Practically here, the same as a radioisotope.
RADSAFE	A co-ordinated plan designed to provide expert assistance to the emergency services following an incident involving the transport of radioactive material.
Railway Safety Case	The Railway (Safety Case) Regulations 2000 require those providing railway infrastructure or operating train services to prepare and submit a safety case setting out: • safety policy and objectives • a risk assessment • safety management systems • risk control measures The new safety case regulations came into force at the end of 2000. These transfer the responsibility for accepting all railway safety cases to the Inspectorate.

Reactor de-fuelling	The process of removing the spent nuclear fuel from a reactor core.
Reprocessing	A process or operation, the purpose of which is to extract radioactive isotopes from spent nuclear fuel for further use.
RID Directive	An acronym for the "EU regulation concerning the international carriage of dangerous goods by rail" as described in "Council Directive 96/49/EC of 23 July 1996 on the approximation of the laws of Member States with regard to the transport of dangerous goods by rail".
Risk	The measure of hazard, danger or chance of harmful or injurious consequences associated with actual or potential exposures.
Spent nuclear fuel	Nuclear fuel removed from a reactor following irradiation, which is no longer usable in its present form because of depletion of fissile material, poison build-up or radiation damage.
Thorp	Thermal Oxide Reprocessing Plant at Sellafield, Cumbria, owned and operated by BNFL. Capable of reprocessing both spent uranium oxide and PWR fuels.
Waste	Material for which no further use is foreseen. For legal and regulatory purposes, radioactive waste is that which contains or is contaminated with radionuclides at concentrations or activities greater than clearance levels as established by the regulatory body. In the UK it is classified into Very Low Level, Low Level, Intermediate Level and High Level.

Annex D

List of acronyms used in this report

AGR	Advanced Gas Cooled Reactor
BNFL	British Nuclear Fuels plc
CND	Campaign for Nuclear Disarmament
COGEMA	Compagnie Generale des Matieres Nucleaires
DETR	Department of the Environment, Transport and the Regions (relevant responsibilities now with DTLR)
DRS	Direct Rail Services (BNFL-owned rail service)
DTLR	Department of Transport, Local Government and the Regions
DWL	Derived Working Level
EU	European Union
GLA	Greater London Authority
GLC	Greater London Council
HSE	Health and Safety Executive
IAEA	International Atomic Energy Agency
JASM	Jointly Agreed Sampling and Monitoring Project
KARE	Kent Against a Radioactive Environment
LAS	London Ambulance Service
LEPF	London Emergency Planning Forum
LESLP	London Emergency Services Liaison Panel
LFEPA	London Fire and Emergency Planning Authority
NGO	Non-Governmental Organisation
NRPB	National Radiological Protection Board
NTAG	Nuclear Trains Action Group
PWR	Pressurised Water Reactor
RMTD	Radioactive Materials Transport Division (of the DTLR)
THORP	Thermal Oxide Reprocessing Plant
UKNFLA	United Kingdom Nuclear Free Local Authorities

Assembly Scrutiny: the Principles

The powers of the London Assembly include power to investigate and report on decisions and actions of the Mayor, or on matters relating to the principal purposes of the Greater London Authority, and on any other matters which the Assembly considers to be of importance to Londoners. In the conduct of scrutiny and investigation the Assembly abides by a number of principles –

scrutinies aim to recommend action to achieve improvements;

scrutinies are conducted with objectivity and independence;

scrutinies examine all aspects of the Mayor's strategies;

scrutinies consult widely, having regard to issues of timeliness and cost;

scrutinies are conducted in a constructive and positive manner;

scrutinies are conducted with an awareness of the need to spend taxpayers money wisely and well.

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Haddii adiga, ama qof aad taqaanid, uu doonaayo inuu ku helo koobi ah warbixinta oo kooban iyo talooyinka far waaweyn ama farta qofka indhaha la' loogu talagalay, ama luuqadooda, oo bilaash u ah, fadlan nagala soo xiriir telefoonkan 020 7983 4100 ama email-ka cinwaanku yahay assembly.translations.gov.uk

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